

Assignment 3 - Conditionals

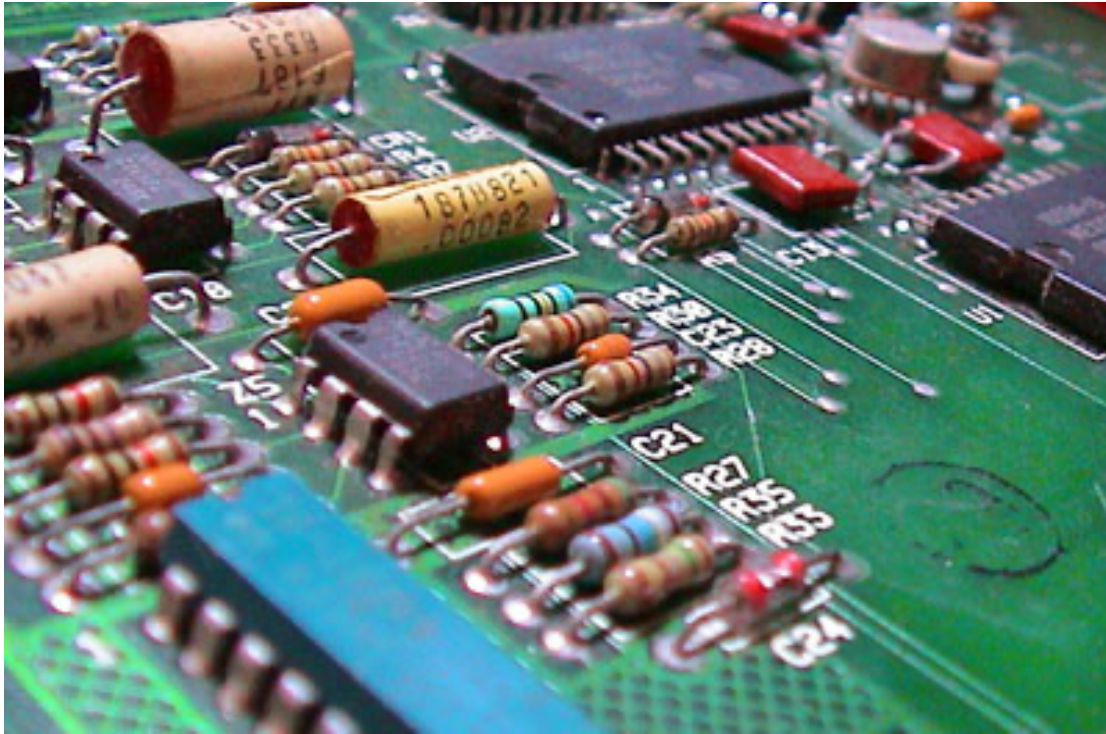


Figure 1: Electronic Printed Circuit Board. Wikimedia Commons

**Objective:**

In this assignment, you will use conditional statements to create a program to examine an electric circuit with various components.

**Background:**

In the diagram below represents the circuit that will be examined in this assignment

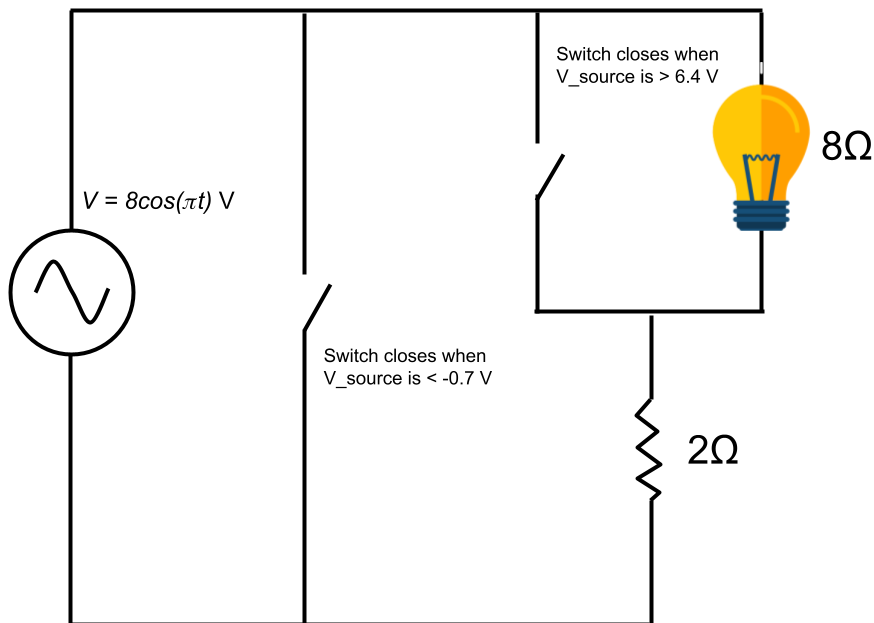


Figure 2: Circuit Diagram of the Lightbulb Circuit

Two switches are used in the circuit below to protect a lightbulb. The source is an AC source that outputs a voltage of  $v(t) = 8\cos(\pi t)$  where  $t$  is time after the circuit is turned on.

- Switch 1 is positioned to protect the bulb from negative voltages. It activates when the voltage across that diode (source voltage) is **less than -0.7 V**.
- Switch 2 is positioned to protect the lightbulb from large positive voltages that may break the bulb. It activates when the source voltage is **greater than 6.4 V**.

When a switch is closed, it becomes the **path of least resistance**. This means that all the current flows through that path, and **any other components that are in parallel with that diode have 0V of voltage**.

- When Switch 1 is closed, no current goes through any components on the right of Switch 1
- When Switch 2 is active, no current goes through the lightbulb.

The bulb has a minimum voltage of 1 V and a maximum voltage of 5.2 V in which it lights up. If the voltage in the bulb is out of this range, the bulb will not turn on.

To calculate the voltage in the lightbulb, use the Ohms Law equation:  $V = IR$ , as well as the fact that the total resistance of this circuit is the sum of all the resistances that current flows through.

### Instructions:

Below is a guideline for how to approach this problem, though you may choose to approach it however you wish. **Make sure to express your results using the format specified below:**

## APSC 143 – Introduction to Programming for Engineers

- Ask the user to input a value for the time elapsed after the circuit is turned on.
- Calculate the voltage being outputted from the source. Print one of the three statements below:
  - `"Source voltage is positive"`
  - `"Source voltage is negative"`
  - `"Source voltage is 0"`
    - Due to variable accuracy, values between -0.01 V and 0.01 V are considered 0 V.
- Determine which switches are closed. Use this information to determine the voltage across the lightbulb. Print which switches are closed to the console.
  - It may be helpful to draw a circuit with switch 1 closed, and a circuit with switch 2 closed to help you visualize the current flow of the circuit.
  - **Make sure you understand the concept of "Path of Least Resistance".**
- Print the voltage across the bulb to the console.
- Determine if the bulb is "on" or "off" based on the criteria above, print either:
  - `"The bulb is on"`
  - `"The bulb is not on"`

It is encouraged that you use nested selection structures for this assignment, though not required.

**Comments are mandatory for this assignment.** Add comments as necessary for key pieces in your code, such as variable declaration, conditional statements, and looping conditions to explain what the program is doing.

**Your output must match the sample output below exactly;** otherwise, the auto grading software will not be able to grade your assignment, which may affect your mark.

### Example Output:

(Note: You **DO NOT** need to print the values in bold; they are shown only to display the **scanf** input for this example.)

(Note: Make sure that and that the last line also prints a new line for Mimir to give full credit.)

```
Enter time in seconds: 2.25
```

```
Source voltage is positive
```

```
The Voltage of the bulb is 4.53 V
```

```
The bulb is on
```

```
Enter time in seconds: 6.8
```

```
Source voltage is negative
```

```
Switch 1 is closed
```

## APSC 143 – Introduction to Programming for Engineers

The Voltage of the bulb is 0.00 V

The bulb is not on

### Submission Instructions:

Create your program using CLion and upload it to Gradescope for grading. **Your program file must be named “apsc143assign3.c”** in order for your assignment to be graded. Do not include any personal information (student number, name, etc.) in your submission. If you have consulted any resources to complete your work, indicate those resources in your comments. Also, include in your comments that you **attest to the originality of your work**.

Refer to the assignment rubric on OnQ for a detailed breakdown of the grading criteria. Your submission must adhere to the assignment rules as outlined in the submission policy document for this course, which can also be found on OnQ. There is zero tolerance for plagiarism in this course. This auto grading software will automatically flag potential cases of plagiarism, which will be reviewed by the instructors.

More information on assignment submissions can be Found in Week 2, and information on the specific definition and repercussions of plagiarism can be found in the “Begin Here (About This Course)” module.